# Multidisciplinary Design Analysis and Optimization (MDAO)

A software framework for system-level design optimization

TECHNOLOGY OPPORTUNITY

NASA's Glenn Research Center invites companies to establish partnerships to explore the use of OpenMDAO for design optimization. MDAO techniques provide a means to simultaneously consider design issues such as performance, fuel efficiency, crash worthiness, manufacturability, and cost early in the design phase of a product.
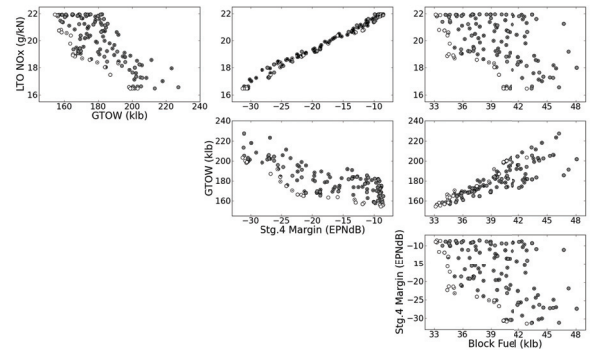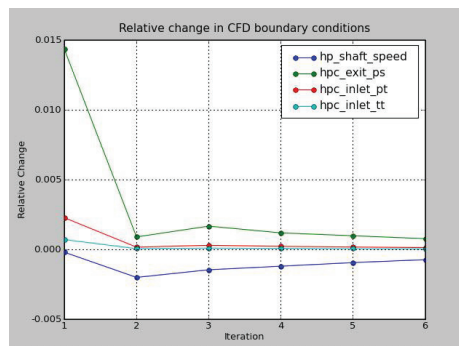
BENEFITS

- **Versatile:** Framework allows integration of separate discipline codes (e.g., C, C++, and FORTRAN) through direct memory wrappers or file wrappers
- **Maintains proprietary integrity:** Nonviral open source license (Apache V2.0)
- **System level evaluation tool:** 80 percent solution prior to preliminary design

Design Tools

AUTOMOTIVE INDUSTRY WORKSHOP
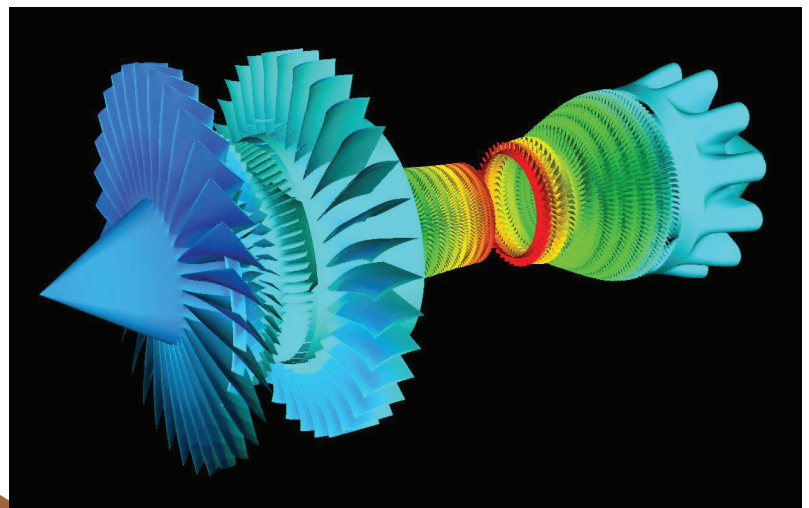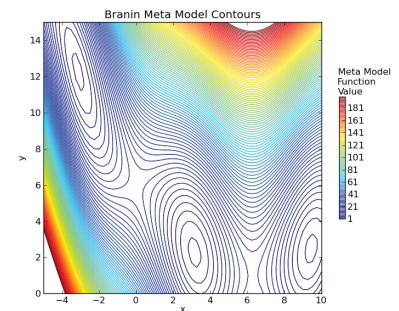
TECHNOLOGY DETAILS

Studies have shown that when optimizing for system-level metrics (cost, fuel burn, crash worthiness, interior volume, etc.), the design of individual subsystems can end up being nonintuitive. MDAO techniques provide a means to simultaneously consider multiple design issues. OpenMDAO provides a suite of tools to facilitate the integration of existing analysis codes, prototype new analysis methods, and connect all of those things together into a comprehensive system model so that MDAO can be easily applied to your problems.

HOW IT WORKS

MDAO is a Python-based engineering software framework that facilitates the linking of analysis and codes together from multiple disciplines at varying levels of fidelity. It also provides a number of solvers and optimizers (e.g., genetic, gradient-based, Broyden, and Gauss-Seidel Solver algorithms.) OpenMDAO is distributed under terms of the Apache License V2.0, a nonviral open source license.

Branin Function Contours and EI Sample Points
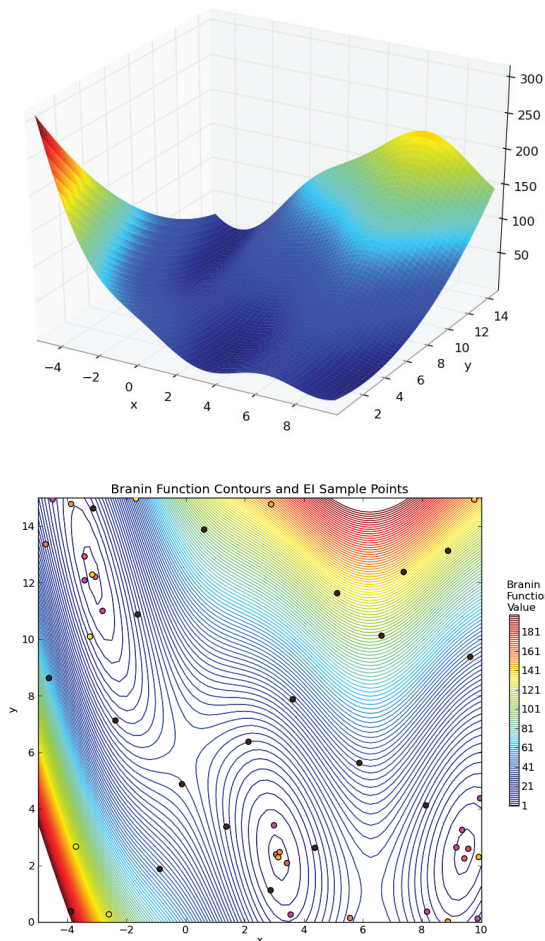
WHY IT IS BETTER

OpenMDAO is being used by researchers at a number of universities (Purdue, Stanford, MIT, University of Michigan, and Georgia Tech) to investigate advanced MDAO tools and techniques. DARPA Vehicle Forge and META are investigating OpenMDAO as a base framework to work from.

OpenMDAO can be deployed across a large organization very easily because there are no licensing restrictions. It provides built-in capability to develop new analysis tools and integrate them with previous tools. It enables optimization, even when expensive analyses such as CFD and FEA are being used, by providing a simple interface to surrogate modeling methods.

The goal of the OpenMDAO team is to develop a common software framework that the engineering community at large can share and jointly develop. Being an open source project means that users are welcome to adopt, change, and modify the framework as they see fit. That flexibility is one of the most valuable features of OpenMDAO.

LICENSING AND PARTNERING OPPORTUNITIES

Glenn's Office of Technology Partnerships and Planning seeks to transfer technology to and from NASA to benefit the space program and U.S. industry. NASA invites companies to consider adopting OpenMDAO and contributing back the OpenMDAO project any improvements that are made (Applied for LEW in 2009).

FOR MORE INFORMATION

For more information about this and other technology licensing opportunities, please contact

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